the same time as the solar prominence cycle. When this happens, the latter fixes the period of the former and greatly increases the range of its phenomena. The best known effect of "resonance" is the semidiurnal variation of pressure.

In the case of Java rainfall the chain of events is briefly as follows: Pressure variations at Batavia coincide with those at Port Darwin in Australia, but the latter have double the amplitude of the former. Consequently, remembering that we are dealing with the Southern Hemisphere, high pressure increases the strength of the east monsoon (November to April) and decreases that of the west monsoon (May to October). It happens that during the former high pressure causes low temperature and is self-sustaining, but during the latter high pressure causes high temperature. This in the course of two years penetrates to the upper air and reduces the pressure below normal. Consequently there is a three-yearly variation of pressure of a "saw-tooth" type, the curve rising slowly for two years and then sinking rapidly for one year. Note that the changes from low to high, or vice versa, can take place only in the west monsoon and the period is thus limited to exactly three years.

It is obvious that a similar sequence of events must take place at many localities near the Equator where conditions are suitable. An example is Lagos, Nigeria, where there is a marked three-year rainfall periodicity. Although pressure data are lacking, we may infer that this is analogous to the case of Batavia, the Sahara taking the place of northern Australia.

A self-regulating system of a different type has been described by W. Meinardus in the north Atlantic.[4] Here ice plays a part. A weak Atlantic circulation means ice at Iceland and little off Newfoundland; this raises the pressure to the east of Greenland and lowers it to the west, causing northerly winds over Baffins Bay and southerly winds at Iceland, so increasing the strength of the Atlantic circulation and reversing the ice conditions. The winter weather in western Europe is known to be influenced by the strength of the Gulf drift, and we may suppose the latter to be affected to some extent by the solar prominence period, acting perhaps only at certain seasons of the year. Hence there are indications of a forced periodicity of three years in the weather of western Europe.[5]

And here, it seems, we have the explanation of why these periodicities so frequently persist for a time, and then break down. For the solar prominence period is not exactly three years, but a few months longer, so that it will gradually outstrip the terrestrial period. After aiding the latter for a few cycles it will gradually come to oppose it, the periodicity will die out, or perhaps skip a year or two, and reappear at the wrong dates, when the resonance is reestablished. This has hitherto been ascribed to a failure of the cycle, but bearing in mind the new principle, it may be possible in the future to forecast these vagaries. Rainfall forecasts based on the modifications of the three-year period are in fact already being issued in Java, and there seems no reason why they should not be equally practicable in other tropical regions.—*C. E. P. Brooks.*

[4] Ann. Hydrogr., Berlin, 1904, p. 353. See further discussion of this and later contributions in MONTHLY WEATHER REVIEW, November, 1918, 46:510-512.
[5] See MONTHLY WEATHER REVIEW, August, 1920, 48:465-466.

22382—20——3

EFFECTS OF HEAVY RAINFALL ON PANAMA-CANAL SLIDES.

Among the engineering surprises attending the construction and operation of the Panama Canal may be mentioned the effects of the heavy isthmian rainfall on the troublesome slides that developed in the banks of the canal as excavation work progressed.

It was generally believed by engineers, as well as by the public, that these slides would be most active and troublesome during the season of heavy rainfall. As a matter of fact, the opposite proved to be the case. Practically all of the extensive deep-seated troublesome slides displayed greater activity in the dry season than during the rainy season. The explanation offered by geologists was that the cohesiveness of the material in the canal banks is greatest when the material is saturated by the heavy rains, enabling it to stand up better than it does during the dry season, when it dries out, tending to lose its cohesiveness and crumble under the weight superimposed upon it.

A type of superficial slide of small extent *has been* more prevalent during the rainy season—loose surface material sliding into the canal under the influence of heavy rainfall, but the mass of material involved has been too small to make the handling of these slides a serious problem.

For example, the troublesome *Cucuracha slide* pushed out across the canal channel during the construction period, with a slow, ponderous, glacierlike movement. This slide has been intermittently active from the early construction days down to the present time, but generally more active in the dry season. It gradually spread until it involved an area of more than 50 acres.—*H. G. Cornthwaite.*